

A REVISION OF THE GENUS *HESPERALOE* (AGAVACEAE)

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ABSTRACT

Hesperaloe is a North American genus consisting of three described species. Recent exploration of northern Mexico for plants with horticultural possibilities has resulted in the discovery of three new taxa. These are geographically isolated from each other and from the three previously described taxa. Descriptions and illustrations for two new species and one new subspecies are provided. A key to all five species is included.

RESUMEN

Hesperaloe es un género norteamericano que consiste en tres especies ya anteriormente descritas. Recientemente se han descubierto tres nuevas taxa en México norteño en exploraciones para plantas con posibilidades hortícolas. Las nuevas taxa están aisladas geográficamente la una de las otras y de las tres descritas anteriormente. Se encuentran aquí descripciones e ilustraciones de las dos nuevas especies y la nueva subespecie. También se incluye una clave de las cinco especies.

INTRODUCTION

Hesperaloe is a North American genus consisting of six taxa. Four taxa occur on the eastern side of the Sierra Madre Occidental, from Texas to San Luis Potosí, Mexico, while the other two taxa occur on the western side of the Sierra Madre Occidental, in Sonora, Mexico (Fig. 1). The genus was erected by Engelman in 1871 to accommodate the recently described *Aloe yuccaefolia* A. Gray. However, Torrey (1859) had previously described *Yucca parviflora* which, according to Coulter (1894) included the taxon then known as *Hesperaloe yuccaefolia* Engelman. The combination became *Hesperaloe parviflora*. (Torrey) Coulter.

In 1862, Koch described *Yucca funifera* which Trelease (1902) decided fit better in *Hesperaloe* and made the combination *Hesperaloe funifera* (Koch) Trelease. It was not until 1967 that another species of *Hesperaloe* was discovered, when Gentry (1967) described *Hesperaloe nocturna* from Sonora. Although flowers of *H. funifera* and *H. nocturna* are similar, plants are distinct vegetatively, separated geographically by about 750 km, and occur on opposite sides of the Sierra Madre Occidental. Engard (personal communication) proposed the name *Hesperaloe chiangii* for plants growing in San Luis Potosí. His life was cut short before he could continue his proposed work on the genus. After examining a specimen growing in his yard, I pursued this taxonomic question. Prior to my ar-

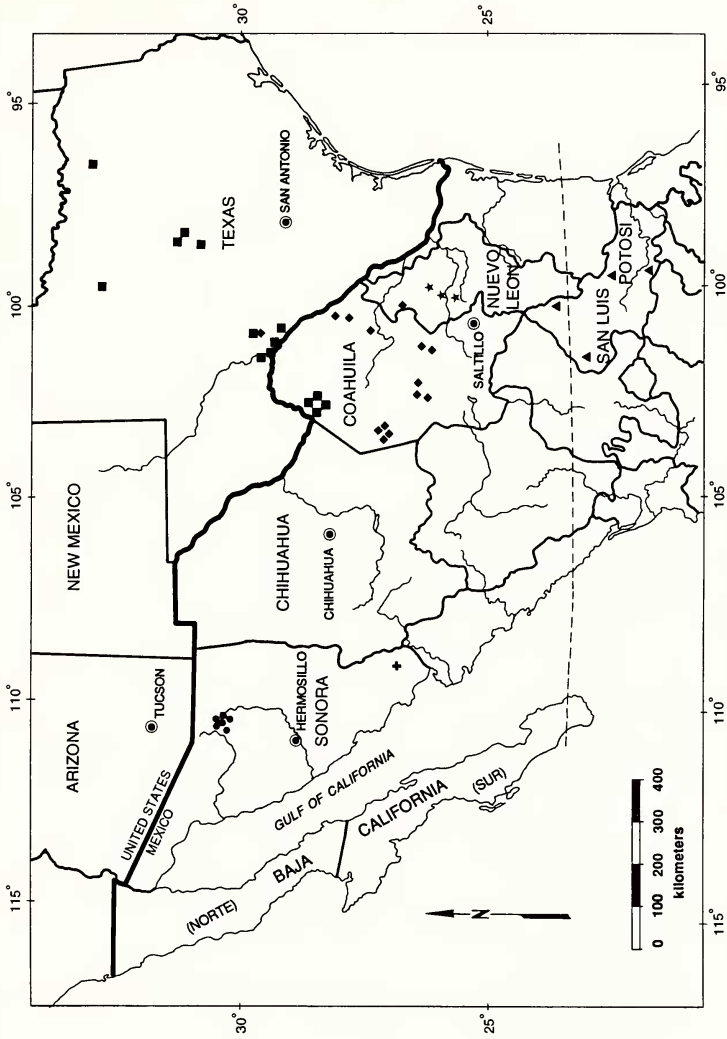


FIG. 1. Distribution of *Hesperaloe*. ★ = *H. campanulata*, ◆ = *H. funifera* ssp. *funifera*, ▲ = *H. funifera* ssp. *chiangii*, ● = *H. nocturna*, ■ = *H. parviflora*, and + = *H. tenuifolia*.

ranging a collecting trip to San Luis Potosí, two other undescribed taxa were found in two widely separated localities, one occurring in central Nuevo León, Mexico, the other in southern Sonora, Mexico. In light of these developments, it became apparent that a revision of the genus *Hesperaloe* was needed. The present revision is based on field and horticultural work with all taxa.

SYSTEMATIC TREATMENT

HESPERALOE: Engelmann in King, Geological Exploration of the 40th Parallel. 5:497. 1871.

Short- to long-rhizomatous perennials with stemless rosettes of leaves either tightly packed or widely separated and forming large rings. Main roots thick and fleshy, with many fibrous feeder roots. Leaves few to many, either thin, narrow, and arching to recurved or thick, broad, and stiffly erect, canaliculate; margins brown or white; marginal fibers thin and tightly curled to thick and nearly straight, white or gray. Flowering stalk terminal from the center of mature rosettes, ascending, to 4 m tall, racemose or paniculate with 3–8 lateral side branches in the upper one-half. Flowers on indeterminate lateral spurs, either on main stalk or side branches. Flower color combination of green, white, and purplish-brown to red, pink, salmon, or coral to rarely yellow. Corolla shape tubular to narrowly to broadly campanulate or rotate-campanulate. Stamens included to exserted. Fruit a woody, dehiscent capsule, beaked or not, transversely rugose, persistent. Seeds large, black, flat, and thin.

KEY TO THE SPECIES

1. Tepals white with greenish purple midstripe, reflexed at anthesis.
 2. Leaves spreading to arching, 1–1.5 m long, maximum width 1–2 cm wide, marginal fibers fine 3. *H. nocturna*
 - 2' Leaves stiff and erect, 1–2 m long, maximum width 2–6 cm, marginal fibers coarse.
 3. Rhizomes short, <30 cm; leaves ≤ 1.5 cm thick at base; marginal fibers ≤ 1 mm diameter; plants from Coahuila and Nuevo Leon 2a. *H. funifera* ssp. *funifera*
 - 3' Rhizomes long, >30 cm; leaves >1.5 cm thick at base; marginal fibers 2–3 mm diameter; plants from San Luis Potosí. 2b. *H. funifera* ssp. *chiangii*
- 1' Tepals pink, red, or coral, reflexed or straight, forming a tube.
 4. Leaves thin and flexible, spreading, 0.5–1.0 m long, maximum width 5–8 mm wide; flowers rotate; tepals pinkish-red, reflexed, to 13 mm long; fruits globose, beakless or with a beak ≤ 1 mm long. 5. *H. tenuifolia*
 - 4' Leaves stiff, upright to spreading, more than 8 mm wide; flowers tubular to campanulate; tepals longer than 15 mm; fruits with beak >4 mm long.
 5. Leaves dark green, recurved and twisting, deeply canaliculate, 30–60(120) cm long, less than 15 mm wide; flowers tubular; seeds 9–10 mm long, 6–7 mm wide 4. *H. parviflora*
 - 5' Leaves medium green, erect to spreading, not deeply canaliculate;

60–105 cm long, 15–26 mm wide flowers tubular-campanulate to campanulate; seeds 6–9 mm long, 5–6 mm wide.
 1. *H. campanulata*

1. ***Hesperaloe campanulata*** G. D. Starr, sp. nov. (Fig. 2)—TYPE: USA, Arizona: (MEXICO, Nuevo León 550 m, 26°13'N, 100°7'30"W) Grown in author's garden in Tucson from an offset collected 11 Nov 1989 at Mamulique micro-ondas; *Starr 93-001* (holotype: ARIZ!; isotypes: TEX!, MO!, MEXU!).

Planta acaulis, cespitosa, 0.6–1 m lata; foliis lineareo-lanceolatus, 60–105 cm longis, 1.5–1.6 cm latis, margine angusto sparse filifero; inflorescentia simplici paniculata, 3 metralis; flores pedicillati, tepala roseus margine albus 18–22 mm longa, 4–8 mm lata; capsulae globosae 2–3 cm longae, 2–2.5 cm latae; semina nigra 6–9 mm longa, 5–6 mm lata.

Plants acaulescent, forming moderately caespitose clumps to 0.6–1 m across. Leaves stiff and erect to slightly spreading, canaliculate, linear-lanceolate, 60–105 cm long, 15–26 mm wide at widest point (one-third from base) tapering to tip, medium green, margins finely filiferous. Inflorescence 3 m long, raceme or panicle with 2–5 branches in upper one-third. Flowers tubular-campanulate to broadly campanulate; pedicels 8–13 mm long; outer tepals linear to linear-lanceolate, adaxial face white, abaxial face pink with broad, white margins, 18–22 mm long, 4–8 mm wide; stamens and pistill included; filaments 14–15 mm long, adnate to tepal base for 3 mm; anther sacs 3 mm long; ovary 6 mm long, 4 mm wide at anthesis, style 9–13 mm long. Capsules globose or oblong, 2–3 cm long (excluding beak) 2–2.5 cm wide, beak 4–11 mm long; seeds black, 6–9 mm long, 5–6 mm wide.

Paratypes. MEXICO, Nuevo León; 13 miles N of Sabinas Hidalgo, Mexico highway 85, 400 m, 26°38'N, 100°01'W 15 Aug 1990 *Starr 90-001* (ARIZ); 35 miles N of Sabinas Hidalgo on Mexico highway 85, 100 m, 26°52'N, 99°49'30"W, 16 May 1991, *Starr 91-001* (ARIZ).

Phenology and distribution (Fig. 1). Flower spikes begin to appear in late March or early April with flowering extending into October. Flowers open in the evening and are pollinated during the night by bats and hawkmoths. The following day, flowers close some, forming a tube and are visited by hummingbirds. *Hesperaloe campanulata* occurs in open Chihuahuan Desert scrub on limestone slopes and hillsides. Associated species include *Acacia berlandieri*, *Acacia farnesiana*, *Acacia rigidula*, *Bauhinia lunarioides*, *Cassia greggii*, *Cercidium texanum*, *Cordia boissieri*, *Fraxinus greggii*, *Guaiacum angustifolium*, *Leucophyllum frutescens*, *Vauquelinia angustifolia* var. *heterodon*, and *Yucca rostrata*. The species is known

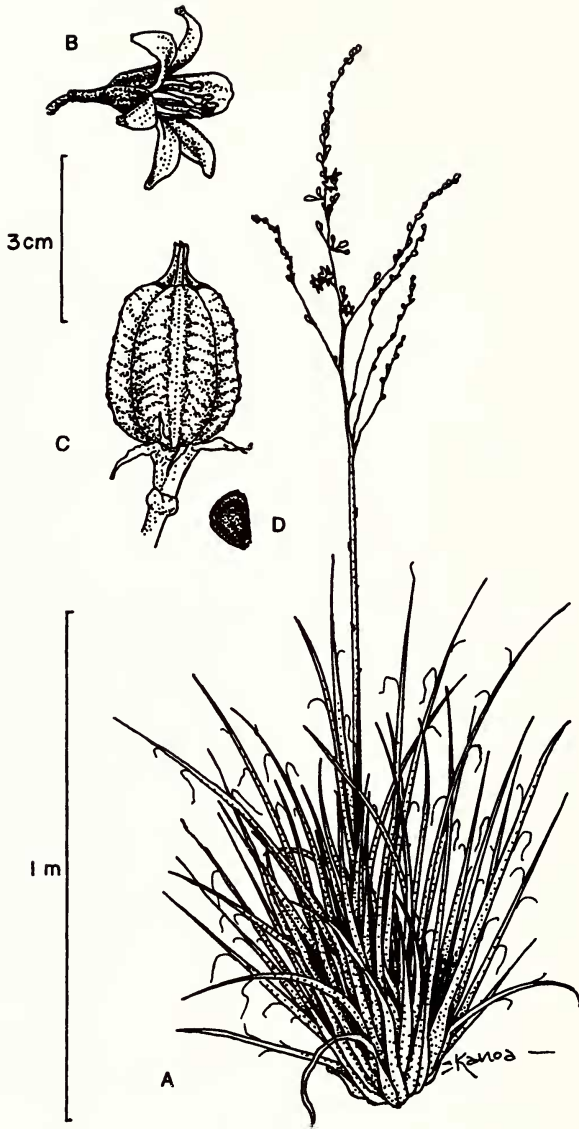


FIG. 2. *Hesperaloe campanulata*. A. Habit. B. Flower. C. Capsule. D. Seed.

only from a limited area in north-central Nuevo León at 500–600 m. Annual precipitation in this limited geographical range varies from 500 to 700 mm.

2. *Hesperaloe funifera* (Koch) Trelease, Annual Report of the Missouri Botanical Garden 13:36. 1902.—*Yucca funifera* Koch, Belgique Horticole 12:132, 1862.—*Agave funifera* Lemaire, L'Illustration Horticole. 11(misc.): 65. 1864.—*Yucca funifera* Lemaire, L'Illustration Horticole. 13:99. 1866.—TYPE: None cited. NEOTYPE (here designated): MEXICO, Coahuila; 4 miles east of Esmeralda Mine along road to Cuatro Ciénegas, 8 May 1973, R. G. Engard and H. S. Gentry 23241 (neotype: ARIZ!).

Hesperaloe davyi Baker, Kew Bulletin of Miscellaneous Information 1898:226.—TYPE: (probably a specimen preserved in K; Baker cited source as plant grown in botanical garden of University of California, Berkeley and sent by J. Burt Davy. (Isotype: UC!))

Plants caespitose, forming clumps up to 1.5 m across, or long rhizomatous and forming fairy rings to 2 m or more in diameter. Leaves stiff and erect, light to dark green or yellowish-green, canaliculate, linear-lanceolate or lanceolate, 1–2 m long, 3–6 cm wide, margins brown, medium to coarsely filiferous with white or gray loosely coiled fibers. Inflorescence a 2–4 m tall panicle with 3–8 branches mostly in upper one-half of stalk. Flowers rotate-campanulate, in indeterminate fascicles; tepals white on adaxial face, 17–20 mm long, abaxial face of inner tepals green and white with a narrow center stripe tinged brownish purple, 8–9 mm wide, abaxial face of outer tepals green at base and reddish purple on upper two-thirds, 6–7 mm wide; stamens and pistil included; ovary at anthesis 10–12 mm long and 4–5 mm wide; pedicel 5–6 mm long. Capsules globose or broadly oblong, 2.5–3.5 cm long 2.5–3.5 cm wide, sharply beaked, beak 2–4 mm long; seeds 8–9 mm long, 5–7 mm wide, black.

In 1862, Koch gave a minimal description of *Yucca funifera* from material given to him by Jean Verschaffelt, a collector of plants for horticulture. There was no type designated and there are no known existing specimens that were used by Koch. Lemaire (1864), without mentioning either Koch or Verschaffelt, described *Agave funifera* from material introduced from Mexico by the Tonel Brothers. Again there was no type specimen designated and there are no known existing specimens. Then in 1866, Lemaire in his treatise on *Yucca* wrote that he mislaid the documents concerning this species, and proceeded to give a brief description of *Yucca funifera*. Apparently Lemaire changed his mind on the correct placement of the species, but still did not designate a type specimen. *Hesperaloe davyi* was named by Baker (1898) from material sent to him by Davy. Baker stated that the material he received from Davy was from the garden

at the University of California at Berkeley. Although he did not designate a type, Baker's description fits that of *Hesperaloe funifera*. In 1902, Trelease mentioned that Davy told him (Trelease) that there was no record of the source of the seeds from which the plant Baker used for his description was grown. However, he went on to say that Franceschi of Santa Barbara stated that two original plants were raised, with one flowering in 1898, providing the material for which Baker based his description. Franceschi sent suckers from the other plant to Kew and to the Missouri Botanical Garden. Trelease (1902) listed *Hesperaloe engelmannii* Baillon and *H. engelmannii* Urbina as synonyms for *H. funifera*. However, the references are simply catalog listings and were not nomenclatural acts by either author. Both references are based on Pringle's number 3911 from Hacienda de la Angostura which was originally misidentified. *Hesperaloe engelmannii* was a name used by Krauskopf for plants he collected along the western branch of the Nueces River. Krauskopf described these as having reddish petals that is indicative of *Hesperaloe parviflora*, not *H. funifera*. Therefore, the references to *Hesperaloe engelmannii* as a synonym of *Hesperaloe funifera* are incorrect. Trelease (1902) was the first to make reference to an actual specimen that was collected and deposited in a herbarium. He stated that the Engelmann herbarium (now at MO) contained a specimen collected by Wislizenus in 1847 at Cerralvo northeast of Monterey. He also mentioned capsules collected by Parry in 1878 from "the plains between Monterey and the Rio Grande" as being similar to those collected by Wislizenus. Trelease (1902) mentioned a third specimen that was collected by Wood in 1900 in the state of Nuevo León that is in the herbarium of the Field Columbian Museum. None of these three specimens represent type material and a neotype is hereby designated.

2a. *Hesperaloe funifera* (Koch) Trelease subsp. *funifera*.

Plants caespitose, forming clumps up to 1.5 m across. Leaves stiff, erect, light green or yellowish-green, canaliculate, linear-lanceolate or lanceolate, 1–2 m long, 3–4 cm wide (when flattened) from base to middle, tapering from middle to apex, margins brown, with 1 mm thick, white or gray loosely coiled fibers.

Phenology and distribution (Fig. 1). Inflorescences begin showing in spring with flowers appearing from April through August or September. This subspecies occurs in central and northeastern Coahuila and one locality in western Nuevo León at elevations of 500–1000 m. Average annual precipitation ranges from 100 to nearly 500 mm. Associated plants include *Acacia rigidula*, *Agave lechuguilla*, *Cordia boissieri*, *Larrea divaricata*, *Leucophyllum frutescens*, *Opuntia leptocaulis*, and *Prosopis glandulosa*. There is an unusual popula-

tion that occurs within a five mile stretch along Nuevo León Highway 1. All plants have leaves about 1 m long. Some plants have typical *H. funifera* flowers while others have flowers more campanulate-rotate with tepals flushed pinkish-red along the margin.

Specimens examined. MEXICO, Coahuila; 23 miles SW of Allende, 1 May 1959, *D. S. Correll and I. M. Johnston 21277* (LL); Peyotes (Kilometer 88), 27 Apr 1900. *Trelease* (MO); 63 miles S of Piedras Negras on Mexico Highway 57, 17 Aug 1971, *L. McGill, B. Parfitt, and D. Keil 7841* (ARIZ); on desert near Rancho Santa Teresa S of Castaños, 19 Jun 1936, *F. L. Wynd and C. H. Mueller 187* (ARIZ); 11–12 miles SW of Cuatro Ciénegas on road to San Pedro, 15 Oct 1972, *R. G. Engard and H. S. Gentry 23138* (ARIZ); 2.5 miles E of Esmeralda on road to Est. del Oro, N of Sierra Mojada, 27°16'N, 103°38'W, 20 Sep 1972, *J. Henrickson 7830* (ARIZ); 3–4 miles N of San Lazarus on highway to Monclova, 9 Oct 1972, *R. G. Engard and H. S. Gentry 23108* (ARIZ). Nuevo León; Rancho Resendez, Lampazos, 24 Jun 1937, *M. T. Edwards 341* (ARIZ); 3.9 miles S of Lampazos on Mexico Highway 1, 15 Aug 1990, *G. Starr s.n.* (ARIZ).

- 2b. ***Hesperaloe funifera*** (Koch) Trel. subsp. ***chiangii*** G. D. Starr subsp. nov. (Fig. 3)—TYPE: MEXICO, San Luis Potosí; km 144 on Mexico highway 57 between Matehuala and San Luis Potosí to the west of the pueblito of Pozos Santa Clara, in grasslands with *Agave scabra*, *Cassia wislizenii*, *Koeberlinia spinosa*, *Larrea divaricata*, *Prosopis laevigata*, and *Yucca australis*, 23°15'N, 100°33'W, 1500 m, *E. Garcia Moya s.n.* (holotype: DES!).

Subspecies haec ab *H. funifera* ssp. *funifera* differt planta rhizomatosus longissimus, foliis 6 cm latis, marginalis fibris incrassatus ad 2–3 mm.

Plants acaulescent, long rhizomatous, forming wide clumps or fairy rings to 2 m or more in diameter. Leaves stiff, erect, medium to dark green, deeply canaliculate, lanceolate, reaching 1.5 m long, 5–6 cm wide (when flattened) from the base to the middle, tapering from the middle to the apex, the marginal fibers coarse, 2–3 mm diameter, white to gray near point of attachment, straight to slightly coiled.

Phenology and distribution (Fig. 1). Flowering period for ssp. *chiangii* is currently unknown. When three populations were visited in August 1990 only the population near Santo Domingo, San Luis Potosí, showed evidence of flowering that year. Flower stalks with ripe capsules were present and seed was collected. *Hesperaloe funifera* ssp. *chiangii* is geographically separated from ssp. *funifera*. The subspecies *chiangii* is locally common on flats and open slopes

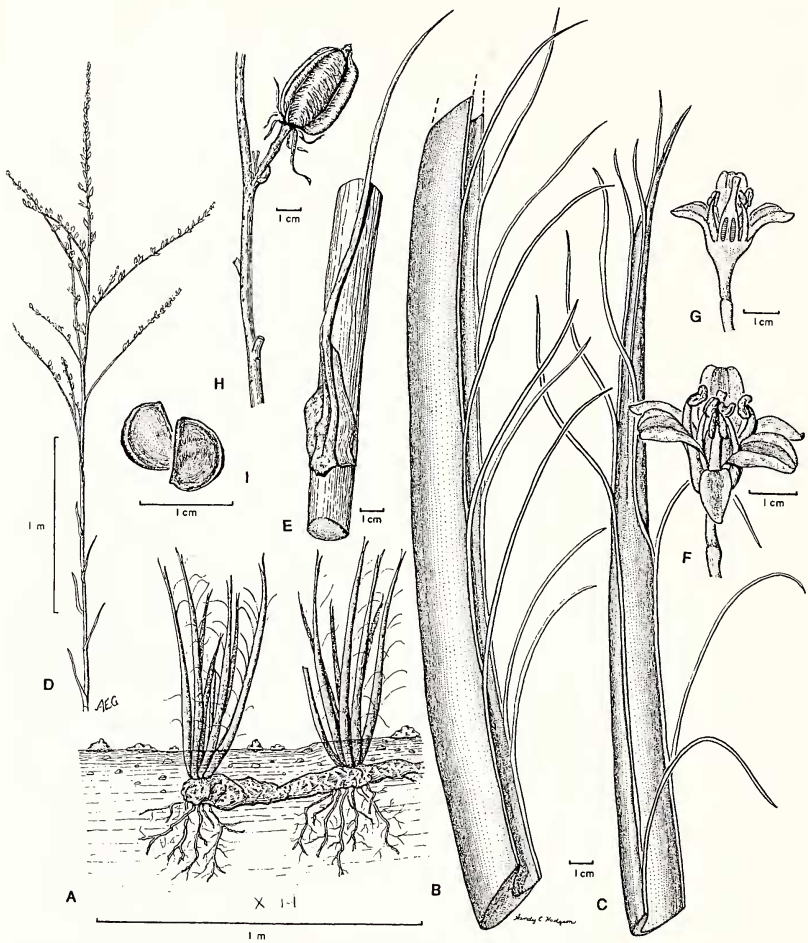


FIG. 3. *Hesperaloe funifera* ssp. *chiangii*. A. Habit. B. Leaf lower 1/5th. C. Leaf upper 1/5th. D. Inflorescence. E. Inflorescence showing bract. F. Flower. G. Flower cross section. H. Portion of infructescence with capsule. I. Seed.

in San Luis Potosí. Average annual precipitation ranges from 300–600 mm. Associated plants include *Acacia* spp., *Agave* spp., *Fouquieria splendens*, *Prosopis laevigata*, and *Yucca filifera*.

Paratypes. MEXICO. San Luis Potosí: Hacienda de Angostura, 5 Aug 1891, *Pringle* 3911 (UC, MO, NY, F, MICH); 12 miles NW of Cd. del Mais along highway to Cd. San Luis Potosí, 19 February 1951, *E. C. Ogden*, *C. L. Gilly*, and *E. Hernandez*. 51119 (ARIZ); km 570 carretera Mexico-Piedras Negras, 18 May 1957, *Rzedowski*

8709 (TEX); near Santo Domingo, Hwy 80, 26–28 January 1952, *H. S. Gentry 11512* (ARIZ).

3. *Hesperaloe nocturna* H. S. Gentry, *Madroño* 19:74–78. 1967.—
TYPE: MEXICO, Sonora; 15 miles SE of Magdalena along road to Cucurpe, by Sierra Baviso, 3,200–3,500 feet, 21 May 1963, *Gentry and Felger 19988* (holotype: US!).

Plants densely caespitose, forming clumps to 1–2 m across. Leaves upright and arching, linear, 1–1.5 m long, 1–2 cm wide at base, long attenuate at apex; margins narrow, brown, finely filiferous with white, irregularly wavy fibers. Inflorescence a slender panicle to 1.5–4 m high, with 2–3 branches in upper one-half. Flowers nocturnal, campanulate-rotate, in indeterminate fascicles; tepals greenish-white on adaxial face 15–25 mm long, abaxial face of inner tepals with broad, reddish-purple center stripe, 8–9 mm wide, abaxial face of outer tepals reddish with greenish-brown center stripe, 6–7 mm wide; stamens and pistil included; filaments attached to base of tepals for 3 mm; ovary at anthesis 10 mm long and 4 mm wide; pedicels 14–16 mm long. Capsules depressed ovoid or oblong, 3–4 cm long, 2.5–4.5 cm wide, short beaked; seeds black, 11 mm long, 8 mm wide.

Phenology and distribution (Fig. 1). Flowering occurs from Apr to Jul, with seed set coinciding with summer rains. Known only from north-central Sonora at 950–1150 m elevation with *Acacia occidentalis*, *Acacia greggii*, *Berberis haematocarpa*, *Cercidium floridum*, *Coursetia microphylla*, *Fouquieria splendens*, *Prosopis velutina*, and *Yucca arizonica*. Also reported from one sterile specimen in northeastern Sonora where it was growing on a steep canyon wall with *Ficus petiolaris*, *Justicia candicans*, and *Quercus* sp.

Specimens examined. MEXICO. Sonora. 20.4 miles SE of Magdalena on Cucurpe road, 11 Apr 1976, *T. R. Van Devender*, *K. B. Moodie*, and *S. F. Hale* (ARIZ); Rancho Noria Aguilarena, N of Ures and Santiago, 29°33'N, 110°25–26'W, 500 m, 9 Jul 1992, *E. Joyal 2054* (ARIZ); Cañon de la Bota, N end of Sierra el Tigre, 34 km (air) ESE of Esqueda, near 30°36'N, 109°13'W, 3300–3600 ft., 31 Jan 1982, sterile specimen, *G. Yatskievych 82-54* (ARIZ); 15 miles SE of Magdalena to Cucurpe, 3200–3300 ft, 21 May 1963, *R. S. Felger 7942* and *H. S. Gentry* (ARIZ); 17 miles SE of Magdalena, Palm Canyon in Cerro Cinta de Plata, 5 Jun 1978, *T. R. Van Devender s.n.* (ARIZ); 15 miles SE of Magdalena, 3000–3400 ft, 21 May 1963, *R. S. Felger and H. S. Gentry 19988* (ARIZ); 17 miles SE of Magdalena, 11 Sept 1934, *I. L. Wiggins 7132* (ARIZ).

4. *Hesperaloe parviflora* (Torrey) J. M. Coulter, *Contributions from U.S. National Herbarium*. 2:436. 1894.—*Yucca parviflora* Tor-

rey, Botany of the Boundary of Emory's Report of the U.S. and Mexican Boundary Survey, 221. 1859.—*Aloe yuccaefolia* A. Gray, Proceedings of the American Academy of Arts and Sciences, 7:390. 1867., illegit., based on *Hesperaloe parviflora* (Torrey) J. M. Coulter.—*Hesperaloe yuccaefolia* (A. Gray) Engelm., in C. King, Geological Exploration of the 40th Parallel, 5, 497. 1871., illegit., see preceding.—SYNTYPES: USA, Texas; "Gravelly hills near the mouth of the Pecos", *Bigelow s.n.* Stony hills west of the Nueces river, *Wright 1908.* (lectotype: GH!; isolectotype: NY!)

Hesperaloe engelmanni Krauskopf, Notice to Botanists. (circular). 1878.—TYPE: none designated. *Hesperaloe parviflora* (Torrey) Coulter [var.] *engelmanni* (Krauskopf) Trelease, Annual Report of the Missouri Botanical Garden, 13:33. 1902.—TYPE: none cited; placed in synonymy here; see discussion under taxonomy.

Plants densely caespitose, forming clumps to 1 m or more wide. Leaves dark green, arching, 30–60 (120) cm long, 8–18 mm wide at base, narrowing to apex, linear, margin finely filiferous, with tightly curled fibers. Inflorescence branched panicle to 1–2.5 m long, the few branches mainly in upper one-half. Flowers diurnal, tubular or oblong-campanulate, in indeterminate fascicles; tepals salmon, coral, pink, or rosy-red, one horticultural selection is yellow, the outer 15–20 mm long, 4–7 mm wide, the inner 17–20 mm long, 5–8 mm wide; stamens included, the filaments 7–13 mm long, attached to base of tepals for 1 mm, anthers 2–3 mm long; ovary 4–6 mm long, 3–4 mm wide at anthesis, style included. Capsule ovoid or oblong-ovoid, 30–40 mm long, 25–30 mm wide, beaked, long pedunculate, rugose; seeds black 9–10 mm long, 6–7 mm wide. *Hesperaloe parviflora* occurs in *Larrea* desert, oak and chaparral zones from 600–2000 m in northwestern Coahuila, and Val Verde, Mills, San Saba, Haskell and Collin Counties in Texas.

Phenology and distribution (Fig. 1). Flowering period for *Hesperaloe parviflora* ranges from March through September. The species is known from central Texas in the Edwards Plateau region and adjacent Mexico.

Taxonomy. In 1859, Torrey described *Yucca parviflora* from gravelly hills near the mouth of the Pecos (*Bigelow s.n.*) and stony hills west of the Nueces, Texas (*Wright 1908*). Then in 1867, Gray decided that the taxon fit into *Aloe* better than *Yucca* and described *Aloe yuccaefolia*. Gray used *Wright 685* with flowers and mature fruit and *Wright 1908*, the same collection used by Torrey for his description of *Yucca parviflora*. Gray (1867) used the specific epithet of *yuccaefolia* because there was already an *Aloe parviflora*. In 1871, Engelm. created the genus *Hesperaloe* and transferred the

recently described *Aloe yuccaefolia*. However, *Yucca parviflora* has priority making the correct combination *Hesperaloe parviflora* (Torrey) Coulter. Krauskopf (1878) proposed the name *Hesperaloe engelmanni* for plants with longer anthers and a short, thick (not filiform) style. These plants were collected along the western branch of the Nueces river while the plants Wright collected came from near the Nueces river and Devil's river. These localities are close enough that neither specific nor subspecific rank should be maintained for those plants until more field research can be done.

Specimens examined. USA. Texas: Mills Co., 1 mile W of Center City on route 84, 27 May 1964, C. E. Smith Jr. and H.-S. Gentry 4322 (ARIZ); MEXICO. Coahuila: ca. 12 air miles E. of Boquillas, 83 road miles NW of Rancho El Jardin, 29°10'N, 102°44'W, 27 July 1973, J. Henrickson 11488 (ARIZ); Los Cojos Minas, SW slope of Sierra del Carmen, 11 October 1972, R.G. Engard and H.S. Gentry 23118 (ARIZ).

5. ***Hesperaloe tenuifolia*** G. D. Starr sp. nov. (Fig. 4)—TYPE: MEXICO, Sonora; 24 km (airline) northeast of Alamos, near Rancho Santa Barbara on Cerro Agujudo, 108°43'43"W, 27°06'50"N, elevation 1500 m, 16 May 1990, S. Meyer and P. Jenkins 9063 (holotype: ARIZ!)

Planta acaulis, caespitosa, 0.5 m lata; foliis linearis-longiapiiculatis, 0.5–1 m longis, 0.5–1 cm latis ad basim, margine angusto sparse filifero; inflorescentia paniculata, 1.5–2 metralis; flores pedicillati, tepala exteriora dorsaliter rosea mediane brunneo-virido ventraliter albida margine rubro, interiora dorsaliter obscure rosea margine albo ventraliter albida, 15 mm longa, 3 mm lata; antheris inclusis, capsulae ovoideae, 2–3 cm longae, 2–2.5 cm latae; semina nigra 6–9 mm longa, 5–6 mm lata.

Plants acaulescent, sparsely caespitose, forming small clumps to 0.5 m wide. Leaves arching, narrowly linear 0.5–1 m long, 0.5–1 cm wide at the base tapering to the apex, margins thin, finely filiferous, fibers white and not tightly curled. Inflorescence raceme or 2–3 branched panicle, to 1.5–2 m long. Flowers nocturnal, rotate; outer tepals linear, 13 mm long, 5 mm wide, dorsal side dark pinkish-red, ventral face white with reddish margin; inner tepals ovate, 15 mm long, 8 mm wide, dorsal side dark pinkish-red with white margin, ventral face white; anthers included, attached to base of tepals for 2 mm, filaments 9 mm long, anther sacs 3 mm long; ovary 6 mm long, 3 mm wide, style 4 mm long. Capsule ovoid, 2–3 cm long, 2–2.5 cm wide, beak none or to 1 mm long; seeds black, 10 mm long, 5–7 mm wide.

Phenology and distribution (Fig. 1). Flowering occurs primarily in April and May with seed maturing in June and July. *Hesperaloe*

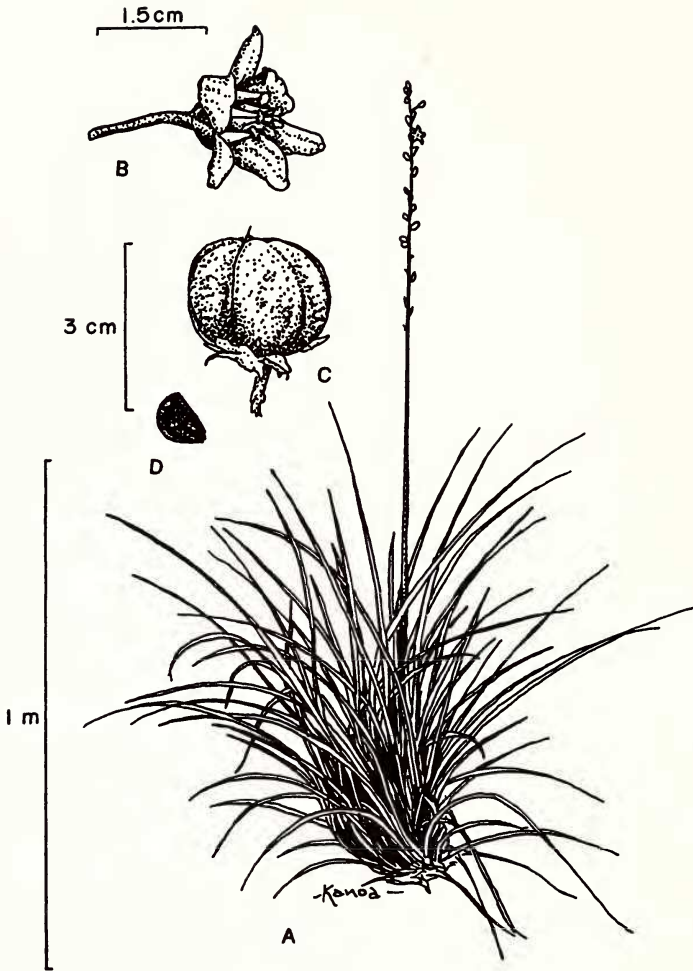


FIG. 4. *Hesperaloe tenuifolia* A. Habit. B. Flower. C. Capsule. D. Seed.

tenuifolia is known only from the Cerro Agujudo northeast of Alamos, Sonora. Plants grow on rhyolitic rock on dry hilltops at 1500 m with *Pinus oocarpa*, *Pinus leiophylla*, and *Quercus tarahumara*.

HORTICULTURE

Hesperaloe has been cultivated in the United States since at least 1878 when Krauskopf offered for sale plants that he collected along the western branch of the Nueces River in western Texas. Prior to that, plants were grown at the botanical gardens in Cambridge from

material Wright collected in 1849. All species are best used in full or reflected sun, and a fast draining soil. The growth rate varies from fast (flowering in 4 years from seed) to moderately fast (flowering in 5 years from seed). The fast growing species are *H. parviflora* and *H. tenuifolia*, and the slower growing species are *H. campanulata*, *H. nocturna*, and *H. funifera*. *Hesperaloe* has CAM metabolism so growth occurs year round. Because of this, they can be grown faster by applying fertilizer and consistent, thorough waterings all year. Amount of fertilizer and water applied will vary with temperature though. All species are quite drought tolerant once established. They will survive on less than 12" of annual precipitation and can go for 2 months or more without supplemental water. No maintenance is required except for removal of old flower spikes if so desired. All species are hardy to at least 15° F with *H. funifera* and *H. parviflora* being hardy to at least 10° F. The flowering period for all species is usually longer for cultivated plants than for wild populations. The application of supplemental water and the warmer temperatures of cities versus the open desert results in flower spikes appearing earlier and persisting later in the year. The flowers of *H. parviflora* are visited by hummingbirds as well as bees. Flowers of *H. funifera*, *H. nocturna*, and *H. tenuifolia* are visited by bats and hawk moths. *Hesperaloe campanulata* flowers are visited by bats and hawk moths at night, and visited by hummingbirds and bees by day.

HYBRIDS

Hybrids in *Hesperaloe* are known to occur. Hybrid plants that were results of the crosses *H. nocturna* × *H. parviflora* (pollen parent undetermined) and *H. parviflora* (male) × *H. funifera* (female) have been observed. F₂ offspring from the *H. parviflora* × *H. funifera* hybrid plants have also been observed. These plants were still young, however some were of flowering age and did show segregation of flower characteristics back towards the parent species. The progeny of *H. nocturna* × *H. parviflora* had the flower color of *H. parviflora* and flower shape intermediate, while the leaves were more like *H. nocturna*. I have made crosses between *H. campanulata* (male) × *H. funifera* (female) and *H. campanulata* (male) × (*H. parviflora* × *H. funifera*) (female). I made the *H. campanulata* × *H. funifera* cross after visiting the unusual *H. funifera* population in western Nuevo Leon. The proximity to both *H. campanulata* and *H. funifera*, along with the variation in flower color within this population, gave me the impression that the plants were of hybrid origin. It is also possible that these plants are the result of a *H. parviflora* × *H. funifera* cross. However, all the flowers had tepals that were flared open like *H. funifera*, whereas I would expect to see flowers

similar to both parents in a segregating population. It seems unlikely that these could be F_1 plants because there are no known populations of *H. parviflora* in the vicinity. Seed has been collected and plants are being grown to further study this variant of *Hesperaloe*. *Hesperaloe campanulata* also is of possible hybrid origin. *Hesperaloe funifera* and *H. parviflora* may have crossed at some point in the past and *H. campanulata* and the unusual plants in western Nuevo Leon could be descendants of that cross. In the field, flower color and shape of *H. campanulata* were consistent, while leaf size was variable. This leads me to conclude that *H. campanulata* is a stable species. However, the population of *H. funifera* in western Nuevo Leon appears to be simply a color variation and therefore not recognizable as a distinct taxon.

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LITERATURE CITED

- BAKER, J. G. 1898. On Aloineae and Yuccoideae. *Journal of the Linnean Society of Botany* 18:228.
- COULTER, J. M. 1894. Botany of Western Texas. *Contributions from the U.S. National Herbarium* 2:588 pp.
- ENGELMANN, G. 1871. In S. Watson (ed.), U.S. Geological Exploration of the 40th Parallel. Report of the 40th Parallel, Vol. 5:525 pp.
- GENTRY, H. S. 1967. A new *Hesperaloe* from Sonora, Mexico. *Madroño* 19(3):74-78.
- KOCH, K. 1862. Exposition quinquennale de plantes et de fleurs Belgique Horticole 12:107-133.
- KRAUSKOPF, E. 1878. Notice to botanists, botanical gardens and nurserymen. Circular.
- LEMAIRE, C. 1864. *Especies Nouvelles D'Agave*. L'illustration Horticole 11:63-66.
- LEMAIRE, C. 1866. Du Genre *Yucca*. L'illustration Horticole. 13:90-102.
- TORREY, J. 1859. Botany of the boundary; Emory's report of the U.S.-Mexican Boundary Survey. 29-270.
- TRELEASE, W. 1902. The Yuccaceae. Report of the Missouri Botanical Garden 13:27-31.